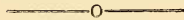



R E P O R T

ON THE

DESTRUCTION OF COCO-NUT PALMS BY BEETLES.



HE damage caused by the ravages of two species of beetles in Singapore to the coco-nut trees has now become so serious, that it is imperative that some steps should be taken to ameliorate the plague without delay. For this purpose, I have here collected all the information I could, both by personal observation of the habits of these animals, and by enquiries of the several planters whose estates have been much affected, and by reference also to published notes in *The Tropical Agriculturist*, and in a paper published by authority of the Straits Settlements Government and written by Dr. SIMON, together with the correspondence on the subject between the various planters and certain Government Officials.

The Species of Beetles.—The two species of beetle which attack palms here are quite different in appearance and habits and in their method of destruction, although they are usually found together, and must be treated of separately. One is *Oryctes rhinoceros*, commonly known as the rhinoceros, elephant or black beetle, belonging to the group of Lamellicornia. The other is *Rhynchophorus ferrugineus*, known as the red beetle: it is a large species of weevil. Two other larger species of Calandra occur in the island, both of which prey on some species of palm, but I have not received any notice of their attacking coco-nuts.

Oryctes rhinoceros.—This beetle belongs to the group of Lamellicornia, the larvæ of which live in decaying vegetable

matter. In the case of this species, the parent beetle deposits its eggs in the decaying stems of coco-nut trees, whether still erect or fallen to the ground. So abundant are they, that I have found as many as forty larvæ, nearly all full grown, in about three feet of a rotten palm-stem. But besides this habitat, it is also stated that the larvæ occur in manure pits, cow dung, tan bark, crushed sugar-canes, and other vegetable remains, and also in mangrove mud; and I have received grubs taken from piles of cow dung and from leaf mould, made by accumulating grass leaves, &c. in a pit, which were quite indistinguishable from those taken from rotten palms. Their existence in mangrove mud seems to me incredible, as it appears highly unsuited for them. I have been unable to get grubs taken from mud, and certainly palms growing near mangrove swamps are not more liable to attack than if they were growing in drier soil. The identification of larvæ of this group is very difficult, and can only be undertaken by an entomologist, as all the grubs of the larger Lamellicorn beetles are very similar, and there are a number of harmless, and even useful, species of this group in Singapore. I have attempted to rear the grubs, but without success, as they invariably die in confinement in a few days.

Description of the Grub.—The larva is a fleshy white grub from two and a half to three inches long when full grown. The head is rounded, broad, hard and of a dark chestnut brown colour, and behind it on the next segment is an angular patch of chitine on each side. The body is swollen at the tail, so that the grub can only lie upon its side, as is usual in this class of larvæ. It is covered with short, scattered bristles, most numerous along the sides just below the spiracles. The legs are about half an inch in length, weak, but chitinous, and covered with bristles. The short antennæ are quite hairless, and the jaws are thick and powerful, black with a single tooth below the sharp cutting point.

Description of the Beetle.—The grub passes into the chrysalis state in the tree or the rubbish in which it has spent its life, merely making an oval nest in the rotten wood in which to dose. The chrysalis is large and fleshy, soft and white,

and has the form of the perfect insect. It appears to remain but a short time in this state, for chrysalids are very rarely found. Hatched in the tree, it soon makes its way out, and eventually flies off to commence its work of destruction. The beetle varies a good deal in size, but is easily recognised. Large specimens are nearly $2\frac{1}{2}$ inches in length and very broad, of a dark brown or black colour, the chitinous coat being exceedingly hard. The head in the male is small and provided with a blunt horn curved over towards the back, half an inch long. The thorax is about an inch long and three quarters of an inch broad, very hard and solid; it is smooth, and scooped out in front, so that it slopes towards the head. The back edge of this depression is notched, and there are two small semicircular depressions on either side of the large one. The wing cases do not cover the body completely; they are broad and oblong and raised over the back, smooth and shining, but dotted all over with minute punctures. The under side of the body is red-brown, mostly hairless, but the mouth and all the face in front of the horn is covered with red hairs. The legs are strong and stout, the second joint being armed with sharp teeth, with the aid of which the beetle can tear its way into the tree. The female insect can be distinguished by its very short horn, not a quarter of an inch long, and by the much smaller depression in the thorax, which is not notched at the back, as it is in the male, than which, too, it is usually smaller. The insects fly briskly at dusk, rather high in the air, attacking the palm trees at night.

Destruction of Trees.—The grub of this insect is quite harmless, and indeed rather beneficial than otherwise, as it assists to convert rotting wood and other vegetable refuse into soil. It is the perfect insect that is so destructive. Its method of attack is as follows. It flies by night to a palm, and makes its way to the base of a leaf-stalk, and burrows into the heart of the cabbage, making a large hole, from which projects a quantity of the fibre of the tree resembling tow. The appearance of a tuft of this is evidence that the beetle has been at work. It remains in the hole usually all the next day, and may be captured in the burrow. It nibbles

in so deeply, that, not rarely, it bites through the growing point in the cabbage, or bud of the palm. More often, the attack is repeated till the rain getting into the burrows sets up decay, which rots the palm through. In either case the tree speedily dies. A tree once attacked seems to be very popular, and I have known palms from which two or three beetles a day could be taken regularly, in spite of all attempts to drive them away by the aid of carbolic acid, salt and other substances.

The following species of palm, besides the coco-nut, have been attacked, and some destroyed, in the Botanic Gardens:—*Cocos plumosa*, *Martinezia caryotœfolia*, *Corypha gebanga*, *Phœnix dactylifera*, *Livistona chinensis*, *Verschaffeltia splendida*, *Areca rubia*, *Hyophorbe amaricaulis*, *Elœis guineensis*, *Sabalum bractulifera*, *Borassus flabelliformis*, and several others; but the Betel nut (*Areca catechu*), the Gomuti (*Arenga saccharifera*), the Sago palm (*Sagus Rumphii*), and the slender-stemmed palms seem never to be attacked. I once found a beetle in the act of gnawing through the leaf stalk of a species of Cycad, mistaking it evidently for a palm-tree. It appears that the object of the beetle in thus attacking the trees is to drink the sweet sap in the bud of the palm.

It is very easy to distinguish trees that have been attacked by this beetle by the peculiar ragged appearance of the leaves. The beetle in burrowing into the bud, often bites straight through the folded leaf in the cabbage, so that when it is unfolded the top is found to be bitten symmetrically off, or each leaflet is perforated regularly. By these appearances, it is easy to tell whether a tree has been attacked or not, and so to judge of the state of the plantation.

I observe that the trees most liable to attack are those in the neighbourhoods of towns. Small isolated patches round the Malay villages in the interior of the island are usually quite free from the attacks, even though the plantations are near mangrove swamps. It has been said that in this position the trees always suffer, and that the grubs are bred in mangrove mud. This is erroneous. I have seen many plantations near mangrove swamps without any trace of damage from beetles,

and it is exceedingly improbable that the grubs are able to live in mangrove mud. When a plantation is abandoned or neglected, as soon as one or two trees die, the beetles come to attack and lay their eggs in the decaying stumps. From one tree they fly to another, and soon the whole plantation is in a dying state, and if there be any other estates near at hand, the beetle goes on to them, and will do a great deal of damage.

It would be easy enough in a clean kept estate to keep down the beetles, but where there is an endless supply of them in an adjoining estate, the matter is of great difficulty, and the destruction is something remarkable. A rotten coco-nut tree lasts a very long time in a state of decay, and over a thousand beetles could be bred from one before it was quite destroyed. Not only do the grubs live in the erect and fallen stems, but the butts left in the ground are often full of them, and I have even seen them in the timber of little bridges made of two or three pieces of coco-nut stems laid across a ditch in a plantation.

Other timber they do not attack, as it does not decay into the powdery, soft mass that they require for the grub to live in.

Methods of Destruction.—The usual method of destruction of this insect in the trees, is to employ men to examine the bases of the leaf stalks of the palms frequently, and to search for the beetles. They are provided with a flexible iron or copper wire terminated by a barb, with which the beetle is speared in its burrow and drawn out. A tree once attacked should be frequently examined, as it is more liable to future attacks than those which have never been attacked. So long as the beetle is killed by the spear, there is no real need to extract it; in fact it is, to a certain extent, advantageous to leave its remains in the hole, as no beetles will again enter the hole while the dead one is there. In any case, it is advisable to plug the holes with bits of rag or tufts of fibre dipped in weak carbolic acid, as this will deter beetles. Many planters affirm that putting salt in the crown of the tree will keep away beetles. I have not found this remarkably successful. Probably the salt is indirectly beneficial by being washed

down to the roots by the rains, and there absorbed, and as anything that improves the health of a tree enables it also to resist and recover from the attacks of insects, the manuring by salt in this manner is of advantage indirectly against the pest. Kerosine and phenyl may also be used in place of carbolic acid, but they are less effective.

Another method of destruction consists in making large fires of the fallen leaves and husks in the plantations at night. The brilliant light of the fires attracts the beetles, which are beaten into the fires by men and boys armed with branches of trees.

Plan for Extermination.—Although it is obvious that there will always be sufficient food in the form of decaying vegetable matter to supply the needs of the beetle, so that it is really impossible to exterminate it, its numbers can be very greatly reduced by destroying in and near plantations all rubbish, leaves, husks and other vegetable refuse, or at least not allowing piles of it to accumulate. All dead trees should be cut into small pieces and burnt. And whereas it is absolutely useless for any cultivator to keep his plantations clear of rubbish in which beetles may breed, while his neighbour has so neglected his trees that they become merely nests of beetles, it should be made compulsory on every cultivator of coco-nuts, to however small an extent, to destroy by fire all dead trees on his grounds; nor should he be permitted even to utilize them as bridges or posts in the plantations.

Rhynchophorus ferrugineus, the Red Beetle.—This is almost more destructive than the preceding kind, and attacks the palms in quite a different method. It is here not the perfect insect, but the grub that does the injuries.

Like the black beetle, the red weevil is nocturnal in its habits, flying at night to deposit its eggs in the coco-nut trees. Possessed of a remarkably long ovipositor, it finds its way to the base of the leaf-stalk of the palm, and pushes the egg as deeply into the body of the tree as it can. It frequently makes use of the holes made by the elephant beetle, and can often be extracted thence by the beetle-spear. The egg on hatching produces a white footless grub, entirely different in

appearance to that of the elephant beetle. It burrows tunnels through the soft growing portion of the palm, and when full grown nibbles its way to the surface, and forming an egg-shaped cocoon becomes a chrysalis, and eventually hatches out into the perfect insect. Some persons affirm that the beetle lays its eggs in the base of the tree, and that the grubs then burrow upwards. I have seen no case of this, nor have I ever seen the beetle at the foot of the tree, unless the palm happened to be stemless. In all the trees affected by the red beetle, that I have cut up, I found grubs only in the soft pithy wood at the base of the cabbage, and here they were sometimes thickly crowded together. I have certainly seen burrows made by some insect in the old stems of the coco palm, but I do not believe that they were the work of this animal, but, probably of some Longicorn beetle, several species of which occur here, and the grubs of which eat hard wood.

Like the elephant beetle, this species attacks also other palms besides the coco-nut. Many of those mentioned as attacked by the former in the Botanic Gardens having also been attacked by the latter.

It is by no means so easy to find out when a palm is attacked by this insect, as it is in the case of the preceding. It works entirely inside the tree, and makes little or no external marks. By listening at the side of the tree the grub can be heard gnawing the wood. But usually the withering and fall of the central shoot is the first sign that anything is wrong. In some cases a tree exudes a shiny liquid having an unpleasant sour smell, which is a sign of serious damage.

Description of the Grub.—The grub is a thick, fleshy, cylindrical, opaque white larva, with no feet or antennæ, quite hairless, except for some scattered hairs on the head and also a few on the tail. The head is small in proportion to the body, oblong and black, with small jaws. The segment next to the head is horny, but softer and paler than the head, with some subtriangular darker patches on either side. The body is curved and wrinkled, and almost equally thick without. The tail ends in a flat, squared process, with a few tubercles on which there are hairs. The grub lives in the burrows which it

makes, and which are full of slimy sap exuded from the injured wood. It moves about by the aid of its thickened segments, and usually burrows transversely through the tree. When full grown it attains a length of a little over two inches.

The Perfect Insect.—The perfect insect varies a good deal in size and colouring. Usually about two inches in length, but often not more than one and a half from the tip of the snout to the end of the tail. Like all weevils, it possesses a long curved snout, which is blunt at the tip, and in the male ornamented with a kind of brush of reddish hairs. The head is very small, and usually more or less red.

The thorax broadest behind and narrowed in front is black, with a broad red band in the centre, smooth and polished. The wing cases are black, sometimes ornamented with red, grooved longitudinally, and squared and blunt at the ends, a good deal shorter than the body. The tail is black, edged with reddish fur beneath. The legs are strong, rather long, black, with a strong claw on the end of the second joint, besides the two small ones on the feet. The antennæ are a little shorter than the snout, abruptly bent in the middle, and ending in a club.

It is the smallest of the palm-weevils here, and is easily known by the colouring. It flies at night, but is rarely seen on the wing.

Method of Destruction and Prevention.—This insect, as has been stated above, is a much more difficult one to deal with, but several of the methods in use for the former species will be equally effective with the latter. The insects, both male and female, may often be found at the base of the leaves, and can be extracted with the beetle-spear before the eggs are laid. They may also be destroyed by fires, as in the case of the black beetle.

Some planters have recommended cutting away the fibrous sheath which surrounds the young stem of the palm, and, as they say, trimming and cleaning the palm. But the result is attended with a certain amount of danger. For there is great risk that the trimmer will accidentally wound the tree with his knife, and the beetle is quick to take advantage of this and

to deposit its eggs in the cut. I quote from *All About the Coco-nut Palm* by Messrs. FERGUSON of Colombo, p. 12:—

“ Scores of instances might be recorded where, till the trees were come into bearing, a red beetle was never seen, but no sooner was the land cleared and the trees trimmed than it made its appearance and became very destructive. On one property, the trimming system had been carried on for years, till indeed more than one-third of the original plants perished before the estate was ten years old, and they were going at the rate of three trees weekly. The work of trimming was stopped for the reason offered above ; the loss of trees continued for some time afterwards, but at the end of six months it had entirely ceased.”

The cutting of notches by climbers in the trunk of the trees has been said to be injurious, under the impression that the red beetle may deposit its eggs in the notches, but, as previously stated, it does not attack old wood, that being too hard for the grub, and besides were it to deposit its eggs on the trunk of the tree, it would be exposed to the attacks of birds and bats during the operation. It certainly, however, does take advantage of the holes made by the elephant beetle, and it is very common to find both kinds of beetle in the same holes. It is very probable that the extermination of the black beetle will greatly reduce the number of the red one, by preventing their getting into the heart of the tree by means of the burrows of the black beetle.

Many planters are of opinion that a tree once attacked by the red beetle should be immediately destroyed, on the grounds that the tree is doomed and the grubs in the tree can then be killed. But a very considerable proportion of the trees attacked recover. Unless one or more of the grubs bores through the growing point at the base of the cabbage, or sets up decay in the heart of it, the palm has a very good chance of recovery. At the same time, a tree once attacked is usually liable to further attacks from both kinds of beetles, and unless it is really a valuable tree, it is perhaps hardly worth attempting to save it. It is hardly necessary to state that when the central bud is destroyed, the palm cannot re-

cover, and is practically dead. In this case, it should be destroyed at once, and the top cut out in order to find the grubs before they escape as beetles. Cutting the grubs out has been tried by several planters, and spearing them through the stem would be equally effective, but the results seem hardly to be worth the trouble. The grub when detected is usually at least half grown, and then deep within the tree, so that the tree has to be very deeply cut into to get at it, and probably this would set up internal decay.

Summary.—It is quite clear that, although it would be impossible to absolutely exterminate every beetle in the place, it will be possible to so far reduce their numbers that the damage done by them is infinitesimal. The large planters may be trusted to keep their plantations clean of any rubbish in which the black beetle may be propagated, and to destroy all dead and decaying palms on the estate, but that will avail little if other persons are permitted to leave dead trees, and piles of tan bark, manure heaps, rotten sugar-cane, &c. in the vicinity of the coco-nut estates, where the elephant beetle may be bred in large numbers. The small cultivator, to whom the loss of a few coco-nut trees is of little importance, should not be permitted to let them get into such a state that they are a source of danger to those of others.

It should be made compulsory upon every person owning coco-nut trees to cut down and burn all palm-trees that are dead upon the ground at once, nor should he be permitted to stack or store the stems in such manner that they can rot upon the ground, nor to use them for bridges or posts.

It should also be prohibited to owners of tan-works, sugar-factories, or other persons in whose trade large masses of vegetable *débris* form a by-product, to permit this refuse to accumulate in such a manner that it threatens the safety of any estate of coco-nuts. As the beetles do not, as a rule, fly to any very great distance, there are spots in which such accumulations would be absolutely harmless, being too far distant from any coco-nuts to send beetles to them, and as in some professions the destruction of such waste might be found very expensive, and perhaps injurious to trade, it might

perhaps be preferable to merely indict any persons owning such refuse as having a nuisance on his property, should it be shown that any of his neighbours' coco-nut trees were suffering from the ravages of elephant beetles; and should grubs be found in the deposit he should then be compelled to destroy it.

If these steps are taken, I believe that the injury to the trees caused by the beetle will be mitigated to a very large extent, and the pest almost eradicated.

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